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COVER

Sailing at Jet Speed—The almost vertical appendage to the wingtip, resembling a small jib sail, is called a winglet. The plane is a new Learjet Longhorn 55, which makes its service debut this year. Gates Learjet was the first manufacturer to use the winglet design in production jet aircraft and with NASA cooperation, the Air Force has now begun testing them on Strategic Air Command tanker planes.

Winglets are lifting surfaces which operate in the vortex, the air whirlpool at an airplane's wingtip which creates drag. The winglet not only reduces the strength of the vortex but also generates its own lift, producing forward thrust in the manner of a boat's sail. The combination adds up to significant improvement in fuel efficiency.

In the recent Presidential Rank awards to NASA executives, Dr. Richard T. Whitcomb, retired aeronautical research manager at the Langley center, was honored for his work in developing the area rule, the supercritical wing and the winglet. "Radical departures from aerodynamic theory", the award stated, that have "resulted in revolutionary advances in aircraft performance."

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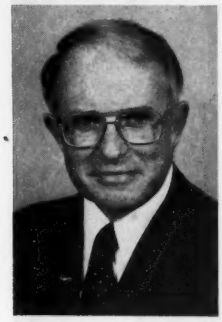
Letter from Washington

Dear Colleagues:



As you will remember, we made a commitment last July, after a thorough examination of the Shuttle program, to launch Columbia on the first orbital test flight in March of 1981. In making that commitment, we recognized that this was a tight schedule, requiring exceptional dedication, judgement and leadership throughout our agency for success. I am glad and proud to be able to report, tight as it is, that schedule is holding. Most program milestones have been met on time. Barring some major, unforeseen difficulty, Columbia will roll-out from the Orbiter Processing Facility later this month and enter the intensive 15-week period of preparation for launch.

All concerned have acted in the NASA tradition of excellence, and in doing so have reenforced and extended that tradition. Congratulations at this point would be premature—but a hearty "Well done!" is not.

Let us continue down the course we have set until that day in March when the hard work of all these years comes to audible and visible fruition on Pad 39A at KSC.

Sincerely,

A. M. Lovelace

A. M. Lovelace

Dr. Frosch to Leave NASA

Dr. Robert A. Frosch has informed President Carter that he plans to leave his post as Administrator of NASA in January. He is the fifth man to head the nation's civilian space agency.

Frosch will be taking over as the first president of the American Association of Engineering Societies (AAES), a federation, created in January 1980, of the major engineering societies in the United States.

After notifying the White House, Dr. Frosch had distributed the following message to all NASA personnel:

"Dear Colleagues:

I have informed President Carter that I will be leaving the position of Administrator of NASA on 20 January 1981. I do so for personal reasons; I can no longer ignore the competitive opportunities available to me and to my family in private life. A unique opportunity particularly suited to my interests has arisen and I must take it.

Working in NASA has been a rewarding experience, both because of the nature of the work, and because of the wonderful, competent people doing it. I deeply appreciate the marvelous cooperation and support I have received from all of you during my tenure. I am confident that our programs will be successful and that NASA will have an opportunity for even greater service to the country and the world than before.

While I will no longer be serving with you directly, I continue to be devoted to our common interests in aeronautics and space and to the advancement of science, technology, and engineering."

Frosch was nominated by the President to become Administrator of NASA on May 23, 1977, and took his oath of office on June 21, 1977. Previously, he had been Associate Director for Applied Oceanography at Woods Hole Oceanographic Institution from 1975 until mid-1977.

A native of New York City, Frosch earned a bachelor's degree in 1947, a master's degree in 1949 and a doctorate in 1952 in theoretical physics, all from Columbia University, New York.

Frosch is married to the former Jessica Rachael Denerstein of Brooklyn, N.Y., and they are the parents of two daughters.

Busy Year for Expendables

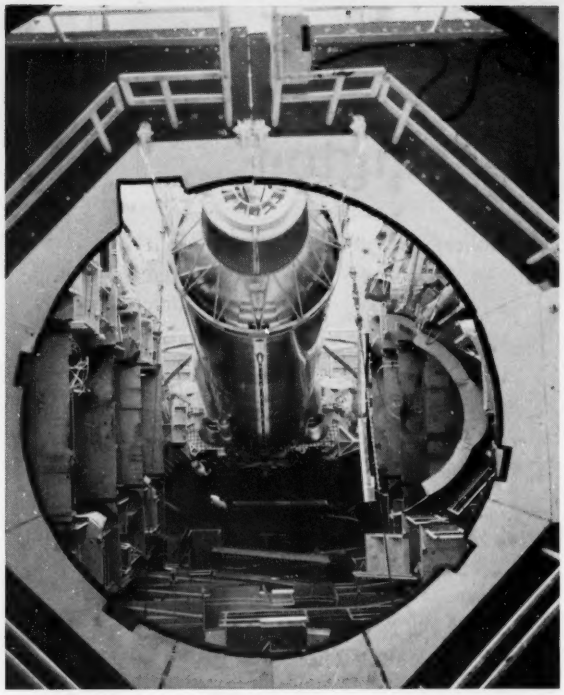
NASA will conduct 18 space missions using expendable vehicles through the end of September 1981, according to Joseph B. Mahon, Director of the Expendable Launch Vehicles Program.

The full schedule involves launching a variety of scientific, weather, communications and Department of Defense satellites from launch sites located at the Eastern Space and Missile Center, Cape Canaveral, Fla.; the Western Space and Missile Center, Vandenberg Air Force Base, Calif.; and the Italian-operated San Marco launch platform in the Indian Ocean off the coast of Kenya.

Seven of the 18 missions will be flown on Delta launch vehicles; seven on the Atlas Centaur; three will use the solid-fuel Scout; and one, the Atlas-F.

Two of the flights will carry scientific satellites, while the remaining 16 will be conducted for other government agencies and private firms for which NASA will be reimbursed. These include three weather satellites sponsored by the National Oceanic and Atmospheric Administration, five Department of Defense payloads and eight commercial geosynchronous communications satellites for Satellite Business Systems, McLean, Va.; Radio Corporation of America, Piscataway, N.J.; and Comsat General Corp. and the Intelsat Consortium, both of Washington, D.C. The expendable launch program is directed by the NASA Office of Space Transportation Operations, Washington, D.C.

Date	Mission	Launch Vehicle
October 28, 1980	FLTSATCOM-D	Atlas Centaur
November 1980	SBS-A	Delta
November 20, 1980	Navy-20	Scout
December 4, 1980	INTELSAT V-A	Atlas Centaur
February 19, 1981	COMSTAR-D	Atlas Centaur
March 1981	GOES-E	Delta
March 12, 1981	INTELSAT V-B	Atlas Centaur
April 1981	SBS-B	Delta
May 1981	Navy-21	Scout
May 1981	NOAA-C	Atlas-F
June 1981	RCA-D	Delta
June 2, 1981	FLTSATCOM-E	Atlas Centaur
June 18, 1981	INTELSAT V-C	Atlas Centaur
July 1981	Dynamic Explorer	Delta
August 1981	Navy-22	Scout
September 1981	Solar Mesospheric Explorer	Delta
September 1981	INTELSAT V-D	Atlas Centaur



Finale for 1980—Looking down from the top of the gantry at NASA Launch Complex 36B, the first stage Atlas Booster is seen in place. Outside the gantry at Cape Canaveral Air Force Station, in the bottom picture, the second stage Centaur is hoisted up to mate with the Atlas first stage. Atlas-Centaur will boost Intelsat V-A, a communications satellite, into orbit no earlier than December 4 in the last launch of the year.

16th Moon of Jupiter Discovered

Dr. Stephen P. Synnott, a Voyager Project navigator at the Jet Propulsion Laboratory, Pasadena, Calif., who discovered a 15th moon of Jupiter last spring, has done it again. He has discovered a 16th Jovian satellite while searching through photos taken last year by NASA's Voyager spacecraft to confirm the discovery of a 14th satellite.

Synnott's newest discovery, tentatively numbered 1979 J3, is about 40 kilometers in diameter. It circles the planet once in 7 hours, 4 minutes, 30 seconds, with an uncertainty of three to five seconds.

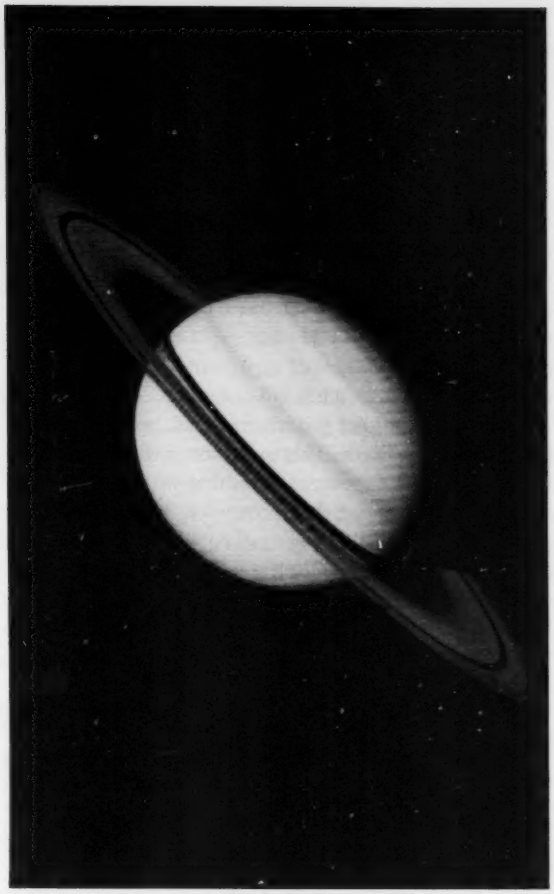
This latest find came from the same process in which he found the 15th satellite in March 1980. Synnott believed at that time that he had confirmed the earlier sighting of the 14th satellite because they had similar orbits and sizes.

The new 16th satellite appears to orbit near the outer edge of Jupiter's ring—also discovered in Voyager photos. The orbit is about 56,200 km above the cloud tops. Synnott still has not confirmed the existence and the orbit of the satellite 1979 J1, discovered in October 1979 from Voyager 1 data.

"I've looked at hundreds of frames," Synnott says, "but it's either too small to see in the pictures or the pictures didn't happen to be taken at the right instant."

Before Voyager 1 reached Jupiter, the planet was believed to have 13 satellites. But in October 1979 a 14th was found (the one Synnott has not been able to confirm). Synnott discovered the 15th Jovian satellite last spring. His latest discovery, number 16, was made this July.

The two Voyager spacecraft are enroute to Saturn after their successful encounters with Jupiter last year. Voyager 1, now into its early encounter phase with Saturn, will make its closest approach on Nov. 12, 1980. Voyager 2, nine months behind, will arrive Aug. 26, 1981. Its trajectory will then take it on to an encounter with Uranus in January 1986.



View from Voyager—This is Saturn, taken by Voyager 1 on September 12, about nine weeks before its closest approach to the planet. At that time, Voyager was 81 million kilometers from the ringed wonder and approaching at a velocity of abou 1,330,000 kilometers per day. In early March 1980, Saturn was at the point in its orbit where the Sun was in the plane of its rings; and since then, the Sun has been slowely "rising" on the northern side of the rings. At the current illumination angle of 30, the rings appear much darker than the planet itself, unlike most Earth-based photograph. Obvious in this image are numerous bands in Saturn's atmosphere, the Cassini and Encke Divisions in the rings, and the ring's shadow on the planet. The Cassini Division is the more prominent gap in the ring's brightness and the Encke is the fainter gap near the ring edge.

New Storm Watcher in Space

The GOES-D meteorological satellite, launched Sept. 9 from the Kennedy Space Center for the National Oceanic and Atmospheric Administration, carries a new type of instrument known as the VAS, or Visible Infrared Spin Scan Radiometer (VISSR) Atmospheric Sounder.

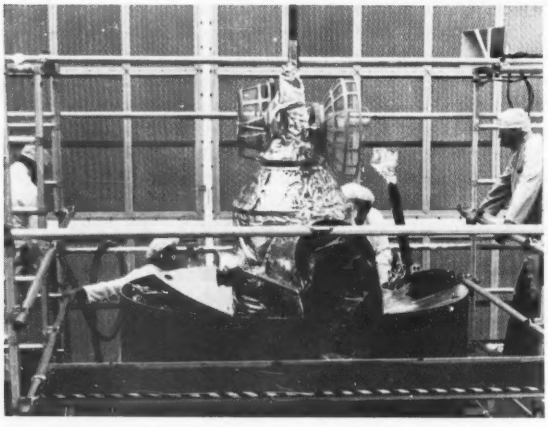
Scientists at NASA's Goddard Space Flight Center,

Greenbelt, and the University of Wisconsin at Madison, will conduct a long-term experiment to evaluate the usefulness of this instrument for prediction of severe local hurricanes, storms and other short-term weather phenomena.

Previous GOES spacecraft provided day and night, two-dimensional cloud cover photos. Now, the new atmospheric sounder, in addition to this same imaging capability, will be able to measure atmospheric temperatures and moisture at various altitude layers. As with previous GOES satellites, the new instrument will provide both day and night cloud cover photos with a resolution of approximately 0.9 kilometers in daylight and 6.9 km at night.

GOES satellites are geosynchronous, hovering over one spot on the Earth. This experiment will inaugurate a new use for these satellites that will require observation scenarios, data processing systems and analysis programs differing markedly from those for polar (north-south) orbiting weather satellites such as the TIROS-N series. Since GOES is stationary with respect to the Earth, it can observe storms as they develop and hence should be useful in a forecast and warning system.

Over the past few years, scientists from NASA, NOAA and the University of Wisconsin have been developing ground-based data processing facilities at Goddard and the University. These facilities will be used during the next few years in this experiment to assess the usefulness of VAS data for weathercasting and for increasing understanding.



The Weather Eye—Technicians perform checkouts on the Geostationary Operational Environmental Satellite (GOES-D) before its September 9 launch from Cape Canaveral. The satellite will provide timely warnings of violent storms, will track hurricanes and collect environmental data—from rainfall to snow depths.

South Africa to Build Landsat Receiver

Dr. Robert A. Frosch, NASA Administrator, and Dr. David H. Jacobson, Vice-President of the South African Council for Scientific and Industrial Research have signed a memorandum of understanding for the establishment of a Landsat ground station at Hartebeesthoek, near Johannesburg, South Africa.

The agreement will permit the South African Council, an early user of Landsat data, to operate an antenna at Hartesbeesthoek; to receive, process, archive and disseminate Landsat data.

The agreement provides that the Council will make the Landsat data it receives available on a public, non-discriminatory basis to anyone requesting it. As a result current and prospective Landsat users in Southern Africa will be able to obtain regular, timely data coverage of their region. This data can make a valuable contribution to the national development efforts of the Southern African countries.

In addition to paying for a ground station and attendant costs, the Council also agrees to pay NASA the current annual access fee of $200,000 beginning after the first six months the South African antenna begins receiving data.

Nine foreign Landsat ground stations are already in operation outside the United States: Prince Albert, Saskatchewan and Shoe Cove, Newfoundland, Canada; Cuiaba, Brazil; Fucino, Italy; Kiruna, Sweden; Tokyo, Japan; Hyderabad, India; Alice Springs, Australia; and Mar Chiquita, Argentina. Procurement of ground station equipment is underway in Thailand and China and a number of other ground stations are in the planning stages.

U.S. ground stations for Landsat are located at Fairbanks, Alaska; Goldstone, Calif.; and at NASA's Goddard Space Flight Center, Greenbelt, Md.

Landsat data are used by scientists and local officials in the United States and more than 100 foreign countries for a wide variety of applications ranging from crop inventories to flood assessment and mineral exploration.

Langley Researchers Study Lightning

Contrary to the old saying, lightning does strike twice in the same place. Confirmation is offered by the National Severe Storms Laboratory in Oklahoma, and personnel from NASA's Langley Research Center, Hampton, Va.

A Langley team of 19 people can testify that

lightning not only struck twice, but three times, as they intentionally guided a modified F-106B jet fighter through severe Southwest thunderstorms this summer.

The tests, done in conjunction with the National Oceanic and Atmospheric Administration storms lab at Norman, Okla., are designed to study lightning from the inside out. Most of what is known about lightning is a result of studies at ground level. Researchers want to know how lighting affects aircraft in flight. As a result, an ambitious program to study lightning in the midst of thunderstorms has a fighter-type airplane seeking to get hit by lightning.

One morning this summer, after attracting no more than a few Oklahoma raindrops on the windshield in more than two weeks of flights, pilot Jerry Keyser was startled by the team's first lightning strike.

"We (Keyser and fellow research pilot Perry Deal) were inside a cloud, with visibility about 152 meters (500 feet). There was heavy rain and moderate turbulence. It didn't look that bad. I probably didn't see the whole thing, but I did see a lightning bolt come out of the fog, horizontally, from right to left," said Keyser, a major on assignment from the Air Force.

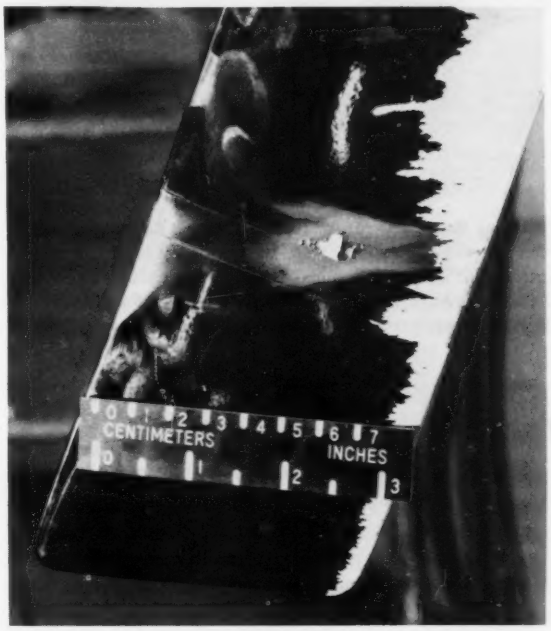
"It curved toward me," he continued, "I instinctively jerked the stick back in an avoidance maneuver. The bolt looked like a headless and tailless snake. It was incredibly fast. Even before I began to react, the 15-to-20 centimeter diameter 'snake' had struck the noseboom and spiraled down the left side of the airplane and was gone. I had my sunvisor down, just in case, and it was still fairly bright. There was a 'zap, crackle,' but there was no radio noise to warn of its coming."

"I was vastly relieved to hear my good friend Jerry Keyser say 'we just got struck,' " recalls mission director Norman Crabill, who for days had worked with storms lab radar controllers directing the craft into and through storm cells in pursuit of lightning. "It meant he was alive, the airplane was intact and that everything we had done to protect them had apparently worked. We had prepared extensively—including actually making tests on the ground with simulated lightning bolts—but this was the first real test."

A landing for an initial strike inspection was followed by an afternoon flight, piloted by Deal, that logged the project's two other direct lightning strikes. The second bolt also struck at the noseboom but the bolt split into streamers down both sides of the aircraft, one attaching to the top of the left wing, and the other attaching beneath the right wing. The third, after also striking the noseboom, "ducked under" to strike two probes located below the fuselage. We felt we had envisioned the lightning hazards pretty well," says Crabill, "not even a circuit breaker tripped."

Initial optimism faded a little, however, when the project's lightning consultant carefully inspected the aircraft after the team returned to Langley. He discovered that at least part of the second strike had skipped down the top middle of the left wing.

To the uninitiated, each of the several strike points might seem insignificant, no more than a rough, but shiny, spot on the wing that could have been caused by the twist of a knife point. But the top middle of the wing, away from the edges and wing tips, is not usually thought of as a lightning attachment zone, according to F-106B project engineer Bruce Fisher. "The thickness of the wing skin," he explains, "prevented a burn through to the underlying fuel tanks. In addition, a low volatility fuel (JP-5) is used in the aircraft to provide an additional margin of safety."



Easy Target—Like a man standing in an open field, this UHF radio antenna was a perfect mark when lightning struck a NASA F-106 over Oklahoma. The bolt hit the noseboom and ducked under to strike the radio probe. Most of the missing paint is due to rain erosion caused by flying through storms at 300 knots but halfway down the antenna is a burn off caused by the lightning.

The sleek fighter plane, capable of supersonic speeds, is on loan from NASA's Dryden Flight Research Center at Edwards, Calif. Even if NASA had not already owned an F-106B, however, it still would have been Langley's top choice for such a demanding mission. Besides thick wing skins, its tough construction has been likened to that of a tank. Its weapons bay is larger than average, making room—in the absence of weapons—for experimental equipment to be packed safely inside.

The F-106 is the holder of the world's single-engine speed record, set in the late 1950s. It is still used by the Air Force and can fly to 15,250 m. The NASA experiments are designed to work up to that altitude, although most flights will be aimed at thundercells around 4,500 m which is the freezing level and, statistically, the altitude where lightning is most likely to strike.

Lightning Bait—The rugged Langley F-106B flown by research pilots Perry Deal and Jerry Keyser. Though 22 years old, it is fast enough and thick skinned enough to be the ideal aircraft for lightning studies. The F-106 still holds the world speed record for a single engine jet.

Team for Mount St. Helens Mission

The space agency and a university research team joined forces in September to mount what scientists consider one of the most significant research missions ever undertaken to understand how volcanos affect Earth's atmosphere, weather and climate and their target is Mount St. Helens.

The mission used a NASA applications satellite, an aircraft crammed with the latest in laser and electronic remote and near sensing technologies, and the expertise of scientists from two NASA centers—Langley Research Center, Hampton, Va., and Wallops Flight Center, Wallops Island, Va.; Drexel University, Philadelphia; the Universities of Maryland, Arizona and Alaska; Dartmouth College, Hanover, N.H.; Michigan Technological University, Houghton; and the Oregon Graduate Center.

During the five-day mission, Sept. 17-21, NASA scientists took transcontinental laser radar soundings for the first time of the volcanic veil which still hangs in the upper atmosphere over the United States. They also obtained measurements of the quantities of certain gases—such as those in the sulfur family—that Mount St. Helens is ejecting into the atmosphere as a function of time.

In addition, the science team investigated how aerosols—or airborne particulates—are dispersed through the atmosphere. Their studies of the composition and morphology—or shape—of the particulates will also tell them something about what is going on inside the volcano.

The mission was a joint effort by the science teams for NASA's Stratospheric Aerosol and Gas Experiment satellite program, and the Research on Atmospheric Volcanic Emissions project, a NASA-funded operation conducted through the various universities. Both activities are elements of NASA's Climate Research Program managed by the Office of Space and Terrestrial Applications.

A typical mission combined a late-afternoon series of volcanic emission measurements in the vicinity of the volcano, followed by underflights of the satellite at dusk.

The satellite was launched in 1979 and has tracked the plumes of three volcanos including Mount St. Helens. The satellite uses a four-channel solar radiometer to take vertical profiles of ozone and aerosols in the stratosphere, which is of particular scientific importance because it is very stable atmospheric region, with no rain and little wind to carry away particles. It is here that the bulk of the ozone resides, which protects life on Earth from harmful wavelengths of solar radiation. The inputs of aerosols from volcanos have long lifetimes, and can possibly affect the weather and climate.

Another element of the mission included studying how sulfuric acid, the main component of acid rain, reacts with other chemicals in the atmosphere, thus adding to man's knowledge of this growing environmental concern. To gain this knowledge, the volcanic emission science team combined the capabilities of eight highly advanced and sensitive instrument packages developed over the past few years at the universities and research centers involved.

Rose Garden Recognition—President Carter, on the left, stands with 25 NASA employees who were honored with two Presidential Ranks—Distinguished Executive, for extraordinary accomplishment, and Metritorious Executive, for sustained accomplishment. The NASA Distinguished Executives, awarded lump sum payments of $19,517, were Dr. Anthony J. Calio, Headquarters; Dr. Christopher C. Kraft, Jr., JSC; William E. Lilly, Headquarters; and Dr. William R. Lucas, MSFC.

Unique Power Plant Possible

A six-month feasibility study has confirmed technical expectations for a unique power plant that could be built at NASA's Lewis Research Center in Cleveland. The plant would use high-sulfur coal without polluting the atmosphere and extract twice as much energy from the coal as under conventional methods.

Known technically as a coal gasifier cogeneration power plant, the facility would gasify high-sulfur coal to produce a clean fuel gas, burn the gas to produce electricity and recover waste heat to produce more electricity as well as heat for the Lewis Center's 130 buildings and test facilities.

Lewis estimates that the plant could be designed and built for $50-to-$70 million. Pending funding, design work could begin in 1981 with the plant in operation beginning in 1984. Funding options are being explored. The study was conducted for Lewis by Cleveland-based Davy McKee Corp., and the Cleveland Electric Illuminating Co. was a participant in the study.

Describing the proposed project, Dr. John F. McCarthy, Jr., Lewis Director, said: "The type of power plant envisioned by the study could have a dramatic effect on lessening this country's dependence on foreign oil and allowing the United States to use its abundant supplies of so-called dirty coal in an environmentally acceptable manner.

"The technology involved would be applicable potentially to the electric utility industry and to any industrial plant that is a heavy user of electrical and heat energy. Significantly, the plant would use proven technologies in coal gasification and cogeneration which means that commercial validity could be established in much less time than needed to prove new technologies."

Specifically, the study provided the conceptual design for a 20-megawatt power plant at Lewis. That would be sufficient power to furnish the center's baseload electrical needs and steam necessary for heating. It would be equivalent to the power needed to supply the electrical needs of approximately 5,000 homes. Peak steam capability will be 90,000 pounds an hour, a rate equal to that required for the average medium-sized industrial plant.

Site of the unique power station would be an existing but presently vacant parcel of land on the south side of the Lewis complex at 21000 Brookpark Road.

The plant would convert some 200 tons of coal a day into a clean fuel gas, equal to a saving of about 1,000 barrels of oil a day.

Lewis believes the new plant could provide savings of from $4-to-$7 million per year on its own fuel bills and reduce total energy consumption of the center by 10 percent from current levels.

In an operating version of the plant, crushed coal is blown into a fluidized bed gasifier (a vertical, cylindrical tank). There, the coal reacts with steam and air at a temperature of about 1,800 degrees Fahrenheit. Under these conditions, the coal is efficiently converted into a raw fuel gas which is drawn off at the top of the gasifier. The sulfur in the coal becomes hydrogen sulfide and come out of the tank as part of the raw fuel gas. A non-leaching, environmentally acceptable ash is withdrawn from the bottom of the gasifier.

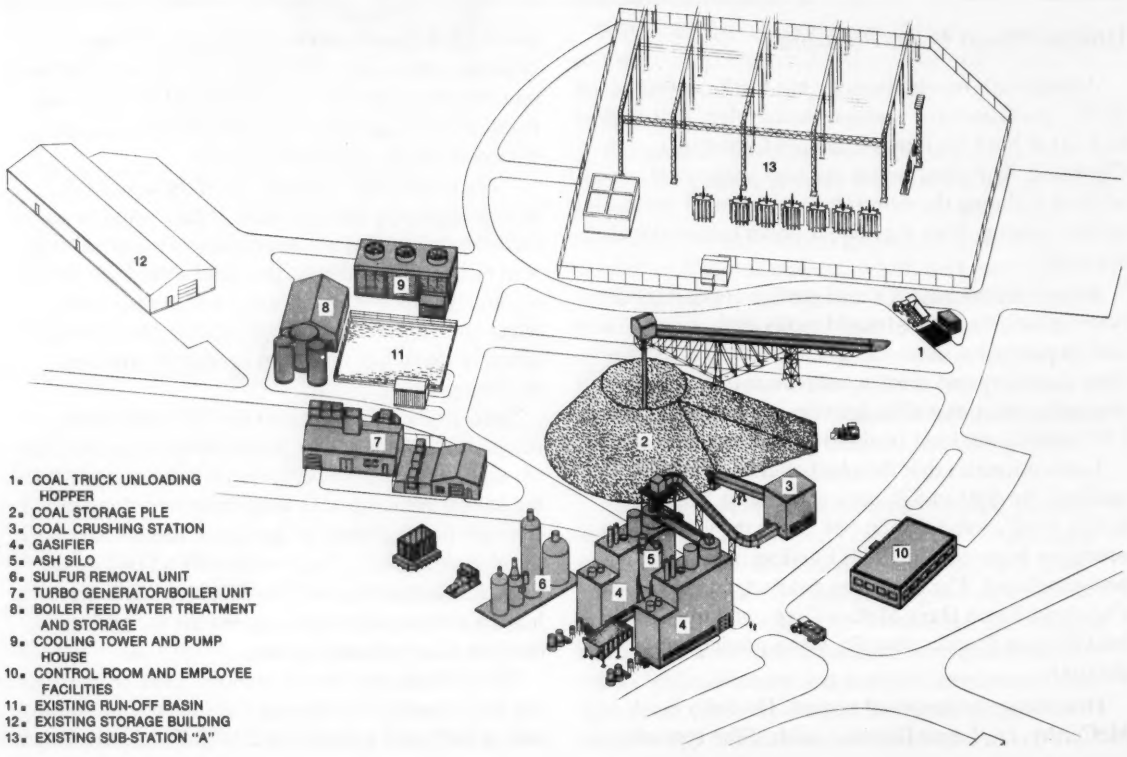
The hot raw fuel gas is cooled down in a heat exchanger where its heat is transferred to water thereby generating high-pressure steam for eventual use in a turbine.

The cooled fuel gas is passed through a clean-up system where suspended particles and gaseous pollutants are removed. The hydrogen sulfide in the gas is converted to elemental sulfur and recovered in the form of a powdered cake. There are a number of ways to dispose of sulfur in this form that have negligible impact on the environment.

The cleaned fuel gas is then burned in a gas turbine which drives a generator for the production of electricity. The hot exhaust from the gas turbine—normally vented to the atmosphere and thus wasted—is then directed through a heat exchanger where it produces high-pressure steam. This steam is combined with that produced in the raw gas cooler and is used either to power a steam turbine which can produce additional electricity or, as low-pressure steam, provide heating for buildings.

Both coal gasification and cogeneration technologies date back to the turn of the century. At one time, for example, coal lamps, using a low-BTU gas made from coal, furnished street lighting for many of America's main streets. Techniques of cogeneration (the recovery of waste heat from one energy source to serve as the fuel for making more energy in a secondary

COAL GASIFIER COGENERATION POWER PLANT


1. COAL TRUCK UNLOADING HOPPER
2. COAL STORAGE PILE
3. COAL CRUSHING STATION
4. GASIFIER
5. ASH SILO
6. SULFUR REMOVAL UNIT
7. TURBO GENERATOR/BOILER UNIT
8. BOILER FEED WATER TREATMENT AND STORAGE
9. COOLING TOWER AND PUMP HOUSE
10. CONTROL ROOM AND EMPLOYEE FACILITIES
11. EXISTING RUN-OFF BASIN
12. EXISTING STORAGE BUILDING
13. EXISTING SUB-STATION "A"

application) were being used by some 30 percent of the industrial plants in this country around the year 1900. The percentage had shrunk to about 5 percent by 1970 because of easy and expensive availability of oil and natural gas.

Lloyd I. Shure, chief of the Lewis Power Systems Branch and project manager for the gasifier/cogeneration project, noted: "The United States has greater coal reserves than any other nation, approximately 30 percent of the world's total supply. According to the Ohio Department of Energy, Ohio alone has an estimated 20 billion tons of recoverable coal. Most of this vast reservoir of energy remains untapped because most electrical generating plants are not designed to burn high-sulfur coal. Even if they were, they would need expensive and extensive scrubbers to meet environmental requirements."

Design Studies for Supercomputer

NASA has selected two corporations to do system design studies for its Numerical Aerodynamic Simulator, a specialized supercomputer, which will assist in developing and testing of new aircraft designs and other flight vehicles, and do general research in such fluid flow areas as meteorology, gas dynamics and computational chemistry. Value of each of the two parallel, firm fixed-price study contracts is $350,000.

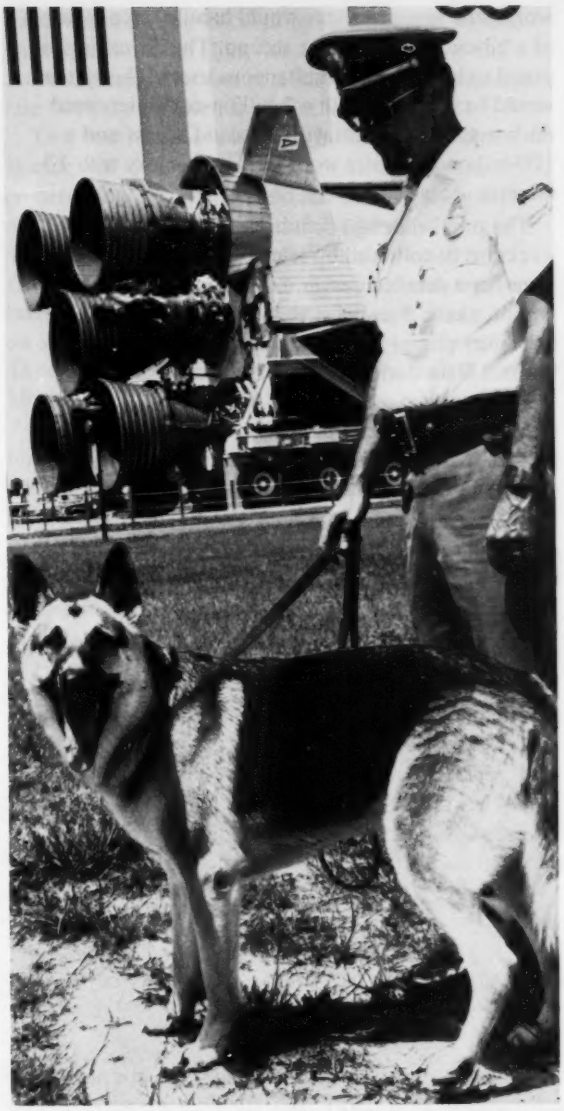
The studies are expected to result in a new data processor which may be 40 times faster than existing supercomputers, with a high speed memory 60 times larger than the current generation of supercomputers.

NASA's Ames Research Center, Mountain View, Calif., has selected for negotiation for the parallel design studies: Burroughs Corp., Federal and Special Systems Group, Paoli, Pa.; and Control Data Corp., Special Programs Division, Arden Hills, Minn.

The new specialized computer uses fluid flow equations to calculate continuously three-dimensional air flows at thousands of points simultaneously. This means the computer can simulate conditions of wind tunnel testing at far less expense than actual model tests in wind tunnels.

Computer simulation will complement wind tunnel tests by substantially reducing the amount of testing required for a particular new aircraft or flight vehicle design, and produce better designs.

Plans call for the proposed new computer to perform 1 billion operations per second using a data base of 40 million words. With a data base of 200 million

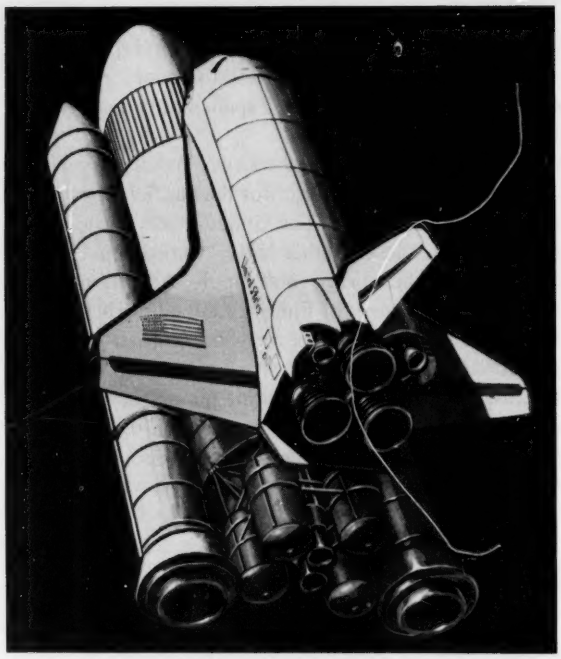


New KSC Personnel—The vigilant dog is Toby, age two and a half, and he poses with his owner and trainer, Sgt. William M. Morris, before the Vehicle Assembly Building at the Kennedy center. Toby joined the Wackenhut security services at KSC this summer and he has proved to be a highly versatile officer. He pulls patrol duty, traffic duty (riding with Sgt. Norris in the front seat), lost children details, and joins in secured area sweeps. Norris says his partner can pick up a scent at 300 yards and can sniff out the presence of the major illegal drugs. The dog is trained to attack and hold; if the subject is armed, Toby will disarm him. As the Kennedy center heats up, facing a tempestous time ahead with the Shuttle flights, it is also equipped to take a bite out of crime.

words, the new processor would handle three quarters of a billion operations per second. The device is proposed to handle 100 simultaneous users. The system would be equipped with a 2-billion-computer-word on-line storage system with 2 second access and a 100-billion computer word off-line memory with 10 minutes access.

The parallel design definition studies are for 40 weeks, to be followed by selection of one of the two firms for a detailed design, fabrication, test and integration phase. Parallel preliminary design and feasibility phases were completed by Burroughs and Control Data during 1977-1979, and work on the system has been underway at Ames since 1975. The design and fabrication phase is planned to be complete in five years, with the new data processor to be operational in October 1986.

The project is part of NASA's aeronautics research and technology program. Ames Research Center has project responsibility for the Numerical Aerodynamic Simulator.



Bigger Shuttle Boost—An artist depicts the Space Shuttle configuration with a liquid boost module positioned at the bottom of the external tank and between the twin solid rocket boosters. Marshall Space Flight Center's Shuttle Projects office has been developing such a plan to provide the additional thrust needed for some near polar orbit missions, and two aerospace contractors are now completing program definition studies. With the liquid boost module, Shuttle's payload carrying capability would be increased from 24,000 pounds to about 41,000. Low altitude near polar orbit flights would be launched from Vandenberg Air Force Base, California.

DOE/NASA Contract for Wind Turbines

Under a Department of Energy-sponsored program, NASA has selected Rockwell International, Energy Systems Group in Canoga Park, Calif., for contract negotiations for the design, construction, installation, and test of an advanced multi-purpose medium-scale wind turbine system.

NASA is negotiating a cost-shared contract with Rockwell for about $9-11 million for the 350-kilowatt wind turbine system with blades 38 meters in diameter.

If the program meet its goals and if the machines are produced in quantity, they should generate electricity at costs comparable with that of many conventional power plants when they are installed in moderately windy areas of the country.

The wind turbine will be designed for sites with an annual mean wind speed of 23 kilometers per hour. Sites with such modest winds are relatively common throughout the United States. The wind turbine is scheduled to be built in late 1983 at a site to be selected by the Energy Department.

The test system will be located at a utility company site and will supply electricity to the local electrical system for use by the general public. The purpose of the test system is to evaluate the economics and to test operating characteristics of an advanced medium-scale wind turbine. This project will place special emphasis on developing lower cost wind turbines capable, when produced in quantities of 100 units or more, of providing electricity at a cost less than 6 cents per kw-hour at windy sites.

The experimental wind turbine (the name for modern electrical generating windmills) in part of Energy's program to develop wind energy systems as a supplementary energy source for the nation. NASA Lewis, with expertise in aerodynamics and structures, directs the portion of the Energy Department's wind energy program concerned with medium and large utility-size wind turbine systems.

Lewis is currently operating a 100-kw, 38-m diameter wind turbine test-bed build for Energy at the NASA Plum Brook test area near Sandusky,

Ohio. This machine is being used to test advanced components and systems which have the potential for improving the performance and reliability of large wind turbines.

Four larger 200-kw versions of this earlier experimental 38-m diameter system are in operation at utility sites located in Clayton, N.M.; Block Island, R.I.; Culebra, Puerto Rico; and Oahu, Hawaii. These machines were assembled and installed by Westinghouse.

A 2000-kw, 61-m diameter machine developed by the General Electric Co. for DOE/NASA is presently being tested and supplying power on the Blue Ridge Electric Cooperative System in Boone, N.C.

A 2500-kw, 91-m diameter experimental machine is being developed by Boeing Engineering and Construction Company for DOE/NASA. Three of these machines are being installed in the first wind turbine cluster at Goodnoe Hills, Wash., on the Bonneville Power System. The first of these will begin operations late this year followed by the other two in 1981.

Two contracts have recently been initiated with Boeing and General Electric each for the design, construction, installation and test of advanced multi-megawatt wind turbines. These machines will be nominal four megawatts each with blades of 91m (300 ft) or more in diameter. The machines are being designed for large power systems at sites with an annual mean wind speed of 14 miles per hour. These wind turbines are scheduled to be built in late 1983 at sites to be selected by the Energy Department.

DOE is also sponsoring the development of wind turbines in various small sizes up to 40 kw. They are designed for residential, agricultural and small industrial users.

Chinese Pose at Ames—A 17-member aeronautics delegation from the People's Republic of China assembled for the group picture with their hosts at Ames Research Center. At center right is ARC Director C. A. Syvertson; to his right is Chinese Vice Premier Bo Yibo. Another Peking delegation also visited NASA Headquarters, and the Lewis, Langley and Dryden centers. The aeronautics experts were invited here by NASA Deputy Administrator Dr. Alan Lovelace, who headed the delegation which traveled to China in June.

Workshop Examines Potential Space Efforts

An orbiting space factory, a self-directed deep-space exploration robot, a fully automated Earth resources and environment monitor and even a lunar base that could grow through self-replication of many of its elements have been examined in a space technology assessment workshop, looking at the next 25 years.

Robotics, artificial intelligence, automation and remotely operated systems are vital to the future of these missions. The enormous benefits of such capabilities at affordable cost has prompted this joint NASA/American Society of Engineering Education summer study at the University of Santa Clara in California.

The 10-week workshop was completed in late August, when an oral report was presented at the University and reports submitted for publication.

The program participants included 18 professors of engineering mathematics and sciences, some 15 NASA engineers and scientists, and a number from interested industrial organizations. The group was drawing on the work of research institutions such as Stanford University, Calif.; Massachusetts Institute of Technology, Cambridge; and Stanford Research Institute in developing computer-based "intelligence" capability.

The workshop was structured to select and define a set of exciting and challenging space missions that would identify critical technology needs for future research and development. As such they are representative of possible future missions rather than specific proposals.

Feasibility analysis has concentrated primarily on four areas:

- A highly versatile "intelligent" satellite information system for most types of Earth survey. Previous systems have suffered from the fact that they record everything they "see," producing huge masses of data.

The proposed information system would do substantial amounts of selection and interpretation of the data coming from its sensors to provide results tailored to the specific needs of the requestor.

In one approach, the system would possess its own world model, stored in a 10-trillion-bit data memory. This would provide reference knowledge of the region of the requested observation.

The satellite would report exceptions to this reference model, such as changes in crop conditions, discarding such well-known phenomena as icebergs, lakes and other landmarks. This would result in a major reduction in the amount of data that must be transmitted and analyzed. The world model would be updated to reflect latest dynamic conditions.

- A second concept is a Deep Space Exploration system to provide reconnaissance, exploration and intensive surface study of planetary bodies.

Specifically, the group is looking at a mission to Saturn's planet-sized satellite, Titan. (Titan has an atmosphere and is bigger than the planet Mercury.) The proposed, self-directed system or robot would combine the functions of several, previously separate missions—orbiter, atmospheric probe and mobile surface-exploration vehicle.

Such self-directed systems could be used to explore distant bodies within the solar system, the outer planets and their satellites, comets and asteroids. It is also the type of system required for the eventual exploration of planetary systems of other stars, where flight and communication times of years, preclude manned involvement and interaction.

- A third area is a facility for use of non-terrestrial materials—from asteroids and moons of Earth and

Low Cost Ingenuity—Keith Clark of the Marshall Space Flight Center demonstrates a small model of the device he invented for handling large metallic structures in space. Basically, the so-called "pneumatically inflatable end effector" is a rubber balloon fed from a compressed air bottle and it is capable of moving lightweight triangular beams. The integral parts of the Clark "end effector" cost 11 cents.

other planets. This would be a permanent, automated Earth-orbiting facility initially using the space environment for unique processing of Earth-supplied raw materials. It would progressively make greater use of non-terrestrial materials. The group is identifying processing and manufacturing techniques well adapted to the space environment. Basic starter facilities are being identified, to be capable of producing a wide range of products and other tools to expand the facility capability.

- Finally, the workshop defined, as an ultimate challenge for advanced automation, a factory on the Moon which would use lunar materials and could replicate itself. One of its first products would be another lunar factory, or factory segment. Such an automated, reprogrammable, self-replicating factory has been of theoretical interest for a number of years, as a way of rapidly expanding utilization of space resources. The workshop has developed proof-of-concept designs and surveyed the types of logical organization for such a factory, and the requirements for an Earth-based demonstration of the concept.

The Shuttle "Navy"—Newest addition to the small fleet that will retrieve the Space Shuttle's solid rocket boosters is the UTC Freedom. It is being fitted out at the Atlantic Marine shipyard, Fort George Island, Florida. The 176-foot-long Freedom is a sister ship to the UTC (United Technologies Corp.) Liberty, launched in the spring. Each of the two ships can retrieve one booster and its associated components and both craft will be used on each Shuttle mission.

Heart Device from Space Technology

The latest of many medical spinoffs developed with space technology is an implantable heart-assist device that could annually prevent thousands of deaths caused by erratic heart action known as ventricular fibrillation.

A pilot study of the device was reported in the *New England Journal of Medicine* by a team of scientists from Sinai Hospital of Baltimore, The Johns Hopkins Medical Institutions and The Johns Hopkins Applied Physics Laboratory. The automated defibrillator—its commercial name is AID—was conceived and invented by Michael Mirowski, M.D., director of the coronary care unit at Sinai Hospital. The device is still in the developmental stage and not yet available commercially.

About 7 centimeters square and encased in titanium, the 255-gram unit is programmed to monitor the heart continuously, recognize life-threatening arrhythmias and provide automatically an electric shock through electrodes directly in contact with the heart to restore the normal heart rhythm.

The device appears similar to the commonly used heart pacemaker but has a markedly different function. Implanted just under the skin in the upper abdomen area in patients subject to ventricular fibrillation—rapid, uncoordinated contraction of heart fibers brought on by grave disturbances in cardiac electrical activity—the device's unique advantage is it is permanently available to the patient without requiring the presence of special personnel or equipment.

Upon implantation, one electrode is affixed to the lower tip of the heart and the second electrode, in the form of a shallow inverted cup, is affixed to the upper border of the heart. The first discharge, or pulse, occurs 15 seconds after the fibrillation begins, to give the heart a chance to correct itself. If the first shock fails to correct the abnormality, three more can be delivered until the heart renews its normal rhythm. The last two shocks, if needed, are of slightly increased intensity. The unit is powered with specially developed lithium batteries having a projected life of three years or 100 shocks.

NASA and Applied Physics Laboratory have developed a monitoring and recording device for the unit which weights 340 grams and can be worn conveniently by the patient. The external recorder monitors the long-term performance of the implanted defibrillator. It is triggered into action by the heart's spasms and stores electrocardiographic data before and after the defibrillator delivers its discharge (shock). It also records the number of fibrillating episodes, pulse applications, the times they occured and the time that elapsed since the last recording.

Space Shuttle Student Project

Rules have been announced for a Space Shuttle student involvement project. a joint venture of NASA and the National Science Teachers Association. The objective of the project is to stimulate the study of science and technology in secondary schools by engaging students in a competition to develop experimental concepts suitable for flight aboard the Space Shuttle.

Up to 200 semifinalists and their teachers will attend preliminary conferences in 10 regions to discuss their proposed experiments with other students as well as NASA and industry scientists. Many of these regional conferences will be held at NASA research centers.

From the 200 semifinalists, 10 will be selected who have developed concepts which best utilize the capabilities of the Space Shuttle These 10 national winners and their teachers will attend a special educational

Gateway to MSFC—James T. Murphy (left), Director of Administration and Program Support at the Marshall center, accepts delivery of the first shipment through the new Huntsville Port of Entry. A U.S. Customs man is handing over Spacelab documentation from West Germany. The airport Port of Entry, just a few miles from the Marshall center, will expedite important shipments to and from the NASA facility.

conference at Kennedy Space Center, Fla., in late summer of 1981. All entrants will receive a certificate of participation.

The Space Shuttle, the world's first reusable spacecraft, is now scheduled for its first manned orbital flight in March 1981. Winning student experiments that are suitable may be performed on flights later in 1981 or 1982.

To announce the formal start of the project, 100,000 four-color posters have been mailed to the nation's secondary schools. Any student is eligible who is regularly enrolled in grades 9 through 12 in U.S. public, private, parochial and overseas schools, including U.S. civil and military overseas establishments, Puerto Rico, Guam, the Virgin Island and U.S. outlying territories.

The contract to conduct the competition and select the winners was awarded by NASA to the National Science Teachers Association, with headquarters in Washington, D.C. Interested students should have their teachers write to the science teachers group for an official entry form, rules booklet and other supplementary material. Teachers should address their request to:

Space Shuttle Program
National Science Teachers Association
1742 Connecticut Avenue, NW
Washington, D.C. 20009

McCormick to Air Force Post

Robert J. McCormick, Executive Officer at NASA since September 1977, was selected as Administrative Assistant to Secretary of the Air Force Hans Mark in August.

McCormick joined NASA in January 1976 after a long career in the Air Force, including assignments in Japan, Korea, France, Vietnam and the United States. His last 10 years were spent in research and development program management and he retired as a Colonel in July 1975. In his new position, he will be responsible for administrative support activities for the office of the Secretary of the Air Force.

A native of Boone, Iowa, McCormick received his bachelor's degree in mechanical engineering and did graduate work at Texas Technological University, Lubbock.

Married to the former Shirley Zerbe of Phoenix, the couple have five children and make their home in Fairfax, Va.

Contractor News

EDG Engineering Incorporated, Houston, has received a $13 million contract from the Lewis Research Center for modernization of the facility's central air system. The 39-month fixed-price contract is effective immediately and work will be performed at the Lewis center and the contractor's Houston plant. EDG Engineering will design, fabricate hardware and software, and install a centrally located control and data acquisition system using modern control and computer technology.

McDonnell Douglas Technical Services Company, Inc. (MDTSCO), Houston, has been selected for negotiations leading to the award of a cost-plus-award-fee contract for performance of Space Transportation Systems Engineering and Operations Support. The contract will apply to technical and analytical support in the areas of engineering systems analyses, flight design, flight operations and management systems support. The period of performance will be from October 1980 through September 1986 and will be divided into three equal contract increments. Management and technical direction will be under the Johnson Space Center and the contractor's estimated cost for the first two-year increment plus a firm two-year option is $25 million.

Aerospace Services Division of Pan American World Airways, Inc., of Cocoa Beach, Fla., has reached agreement on a year's extension of its contract to supply medical services at the Kennedy Space Center and Cape Canaveral Air Force Station. The $2 million award marks the fourth year of service under the contract, providing occupational medicine and environmental health care to civil service, military and contractor personnel.

Rocketdyne Division of Rockwell International Corporation, Canoga Park, Calif., has been awarded a letter contract for materials for six first stage engines in the three stage Delta space vehicle. Value of the contract approximates $4 million, which will be negotiated as a fixed-price incentive agreement.

Boeing Services International, Inc., of Seattle, has agreed to a one-year extension of contract with the Kennedy Space Center for ground systems operations. The contract value is placed at over $49 million. Under its terms, BSI will provide facility and utility operations and maintenance, including propellants, cranes, doors and platforms, elevators, service shops, nondestructive evaluation, life support and industrial operations.

Did You Know?

The European Space Agency has approved a project to send a spacecraft to Halley's comet in this decade. ESA's exploratory mission, bearing the name of Giotto, involves a spacecraft flying to the comet in 1986 at a speed of 70 kilometers a second. The European craft will have a payload consisting mainly of a camera and mass spectrometers for measuring the atomic composition of the target. The mission takes its name from the "Adoration of the Magi" scene in the fresco by Giotto di Bondone, now in the Arena Chapel in Padua, with the comet depicted in the sky background. Halley's comet enters the inner part of the solar system about every 76 years.

NASA Lewis Research Center has won three awards in Industrial Research and Development Magazine's annual national competition, which recognizes the 100 most significant new technical products developed during the past year. The honor is nothing new for Lewis; since the competition began in 1963, the NASA center has won 32 of the awards, sixth best showing among the leading all-time winners.

The Safety Office of the Marshall Space Flight Center, with the endorsement of Center Director W. R. Lucas, this year set out to make 1980 the safest one ever for the Alabama facility. By August 6, Marshall had set a record for its 20-year history—two million manhours worked without a lost-time injury. By the end of August, the figure was even higher—2,450,766.

The Eastern Shore of Virginia is the setting for NASA's newest visitors center, slated for Route 175 adjacent to the Wallops Flight Center airport. A contract was awarded the Taylor Construction Company, Parksley, Virginia, in July and scheduled completion of the building is within 210 calendar days (7 months). The Wallops facility will provide an educational outlet for schools and a theatre for films and exhibits.

Idea Clearinghouse this month acknowledges the good work of the Computer Services Office at the Marshall center. With its improved input processing function, the number of jobs processed has greatly increased and more time is available to center engineers. The office found a solution to the slow batch mode processing system, allowing individual users to key their data through interactive terminals, both printer and graphic types. The user can communicate directly with MSFC's U-1108 computer with a response time of minutes instead of hours or days. Marshall's Charles Houston has the story at (FTS) 8-872-2364.

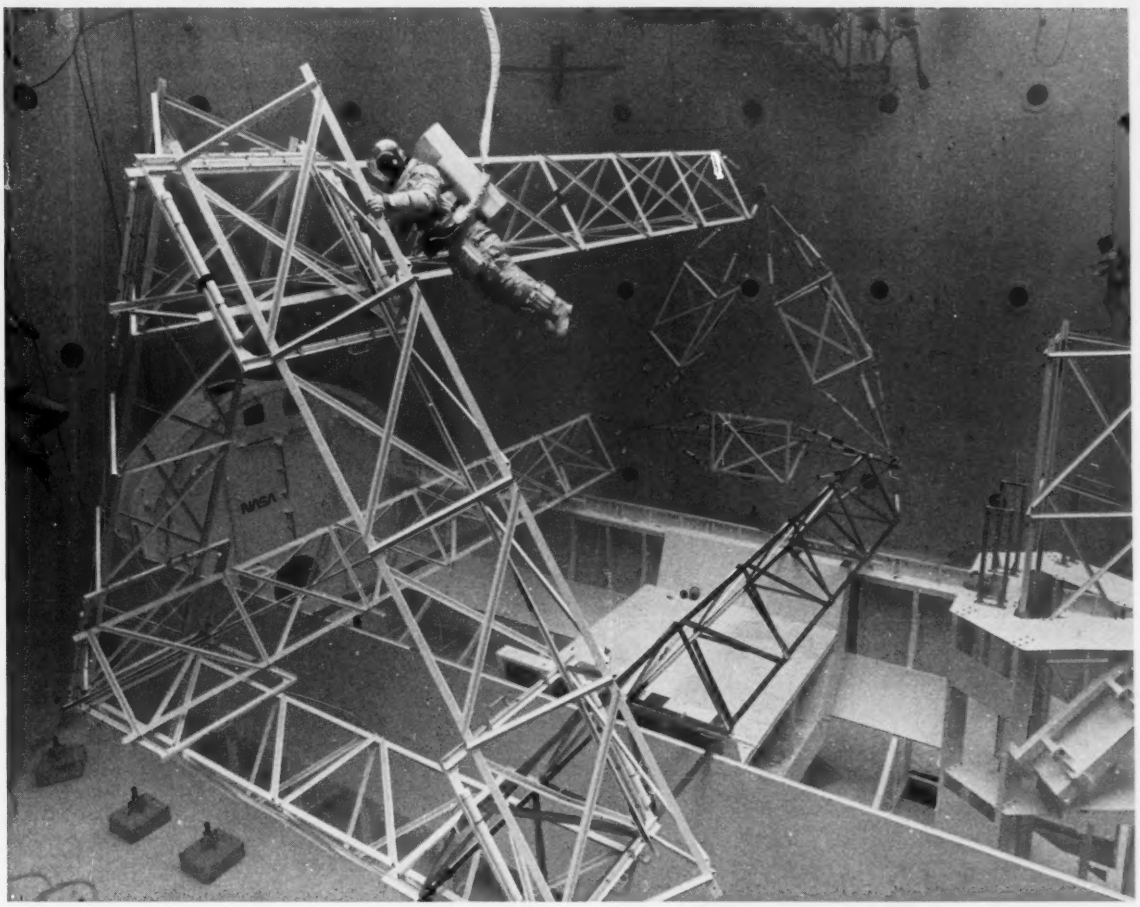
Patents for Inventions from NASA Research

The office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No	Installation
William C. Ruehr, James L. Younghans, Edwin B. Smith, G. E. Company, Cincinnati	Curved centerline air intake for gas turbine engine	4,220,171	LeRC
Joseph T. Bloch, Randolph T. Hanger, Frank W. Nichols, Boeing Aerospace Co., Seattle	Method and apparatus for fabricating improved solar cell modules	4,219,926	NRO/JPL
David T. LaFlame, Hughes Aircraft Company, Los Angeles	Pseudonoise code tracking loop	4,221,005	JSC
Satoshi Nagano, Caltech/JPL, Pasadena	Improved base drive for paralleled invertor system	4,222,098	NRO/JPL
Ralph V. Sawyer, Bill Szuwalski, NASA/Dryden	Computer circuit card puller	4,224,810	DFRC
Dhanvada M. Rao, Old Dominion University Research Center, Norfolk	Aerodynamic side-force alleviator means	4,225,102	LaRC
Jack A. Kinzler, James T. Heffernan, Leroy G. Fehrenkamp, NASA/Johnson	Surface finishing	4,225,372	JSC

Launches for 1980

Name	Launch Date	Vehicle	Range	Mission Remarks
FLTSATCOM-C	January 17	Atlas Centaur	ESMC	DOD Navy. Reimbursable.
SMM-A	February 14	Delta	ESMC	NASA. Scientific Solar Maximum Mission.
NOAA-B	May 29	Atlas-F	WSMC	NOAA Weather. Reimbursable. Launch vehicle failed.
GOES-D	September 9	Delta	ESMC	NOAA Weather. Reimbursable.
FLTSATCOM-D	October	Atlas Centaur	ESMC	DOD Navy. Reimbursable.
SBS-A	November	Delta	ESMC	Satellite business systems. Reimbursable.
Navy 20	November	Scout	WSMC	DOD Transit. Reimbursable.
Intelsat V-A	December	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.



New Starts Underwater—The building process in the Marshall center's Neutral Buoyancy Simulator would now intrigue a big city sidewalk engineer. From handling and grappling with aluminum beams underwater, engineers and astronauts have progressed to putting up impressive structures. In the picture, space-suited engineer Stephen Hall is assembling a triangular prism in "weightless" conditions, working in 1.3 million gallons of water. Someday soon, astronauts may be using such a beam machine carried aboard the Space Shuttle to establish large, beamed complexes in orbit.

Another Dividend from Air and Space

Research and development in aeronautic and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Solar Heat and History

Below the familiar pantheon of great Americans at Mount Rushmore, South Dakota, is a rustic visitors center. It is now a solar-powered facility, one of more than 100 such buildings managed by NASA's Marshall Space Flight Center for the Department of Energy's National Solar Heating and Cooling Demonstration Project. Aim of the program is to promote national energy conservation by stimulating interest in solar energy as an alternative to fossil fuels. The Mount Rushmore installation employs 112 individual collectors, which are smaller than some of the other Marshall-managed fixtures and are flat plates rather than concave. They supply more than half the visitors building's heating and hot water needs and about 40 percent of the cooling requirement. Lennox Industries, Marshalltown, Iowa, produced the Mount Rushmore collectors.*

The Marshall center's role in the National Solar Heating and Cooling Demonstration Project is that of supervisor and technical advisor for a variety of demonstrations in such places as industrial plants, office buildings, schools, museums, libraries and private homes. The center lends its broad solar energy expertise to handling contract negotiations, reviewing designs and overseeing construction. A major Marshall responsibility is monitoring solar equipment performance. Sensors installed by the center's engineers take frequent data samplings at each site. The information is stored on tape and relayed once a day to a central processing facility at MSFC's Huntsville, Alabama, headquarters. There it is analyzed and evaluated to determine the effectiveness of the various types of solar equipment being used in different parts of the country. The process is continuous and conducive to advanced solar energy systems of the future.

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of such technology.

NASA
National Aeronautics and Space Administration

For the benefit of all . . .

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